What is claimed is:

1. A unidirectional fluid valve that comprises:

a flexible flap having a first portion and a second portion, the first portion being attached to a valve seat, the valve seat having an orifice and a seal ridge that has a concave curvature when viewed from a side elevation, the flexible flap making contact with the concave curvature of the seal ridge when a fluid is not passing through the orifice, the second portion of the flexible flap being free to be lifted from the seal ridge when a fluid is passing through the orifice, wherein the concave curvature of the seal ridge corresponds to a deformation curve exhibited by the second portion of the flexible flap when exposed to a uniform force, a force having a magnitude equal to a mass of the second portion of the flexible flap multiplied by at least one gravitational unit of acceleration, or a combination thereof.

2. The unidirectional fluid valve of claim 1, wherein the flexible flap is exposed to a uniform force that acts normal to the deformation curve.

3. The unidirectional fluid valve of claim 2, wherein the concave curvature corresponds to a deformation curve exhibited by the flexible flap when exposed to a uniform force that is not less than the mass of the second portion of the flexible flap multiplied by at least one gravitational unit of acceleration.

4. The unidirectional fluid valve of claim 2, wherein the concave curvature corresponds to a deformation curve exhibited by the flexible flap when exposed to a uniform force in the range of the mass of the second portion of the flexible flap multiplied by 1.1 to 1.5 *g* of acceleration.

5. The unidirectional fluid valve of claim 1, wherein the flexible flap has a stress relaxation sufficient to keep the second portion of the flexible flap in leak-free contact to the seal ridge under any static orientation for twenty-four hours at 70 °C when a fluid is not passing through the orifice.

6. The unidirectional fluid valve of claim 1, wherein the flexible flap comprises crosslinked polyisoprene, is 0.35 to 0.45 millimeters thick, and has a Shore A hardness of 30 to 50.

7. The unidirectional fluid valve of claim 1, wherein the first portion of the flexible flap is attached to the valve seat beyond the area encompassed by the orifice.

8. The unidirectional fluid valve of claim 1, wherein the concave curvature of the seal ridge is defined by a polynomial mathematical equation of at least the third order.

9. The unidirectional fluid valve of claim 1, wherein the orifice has a cross-sectional area in the range of 2 to 6 $cm^2$ when viewed from a plane perpendicular to the direction of fluid flow.

10. The unidirectional fluid valve of claim 9, wherein the orifice is 3 to 4 $cm^2$ in size.

11. The unidirectional fluid valve of claim 1, wherein the first portion of the flexible flap is attached to a flap-retaining surface located on the exterior of the orifice beyond an outer extremity of the curved seal ridge, the point attachment being 1 to 3.5 mm from the curved seal ridge.

12. The unidirectional fluid valve of claim 11, wherein the flap-retaining surface traverses the valve seat over a distance at least as great as the width of the orifice, and the flat retaining surface extends in a straight line in the direction to which the flap-retaining surface traverses the valve seat.

13. The unidirectional fluid valve of claim 1, wherein the concave curvature corresponds to the deformation curve exhibited by the secured portion of the flexible flap when exposed to a force acting in the direction of gravity and having a magnitude equal to a mass of the second portion of the flexible flap multiplied by 1.1 to 2 $g$ of acceleration.

14. The unidirectional fluid valve of claim 13, wherein the concave curvature corresponds to the deformation curve exhibited by the second portion of the flexible flap when exposed to a force having a magnitude equal to a mass of the second portion of the flexible flap multiplied by 1.2 to 1.5 $g$ of acceleration.

15. The unidirectional fluid valve of claim 14, wherein the concave curvature corresponds to the deformation curve exhibited by the flexible flap when exposed to a force having a magnitude equal to a mass of the second portion of the flexible flap multiplied by 1.3 *g* of acceleration.

16. The unidirectional fluid valve of claim 13, wherein the deformation curve corresponds to the deformation curve exhibited by the second portion of the flexible flap when secured at the first portion at an angle Θ to the horizontal in the range of 25 to 65 degrees.

17. The unidirectional fluid valve of claim 16, wherein the angle Θ is about 45°.

18. A filtering face mask that comprises:

(a) a mask body adapted to fit over the nose and mouth of a person; and

(b) an exhalation valve attached to the mask body, which exhalation valve comprises:

(1) a valve seat having (i) an orifice through which a fluid can pass, and (ii) a seal ridge circumscribing the orifice and having a concave curvature when viewed from a side elevation, the apex of the concave curvature of the seal ridge being located upstream to fluid flow through the orifice relative to outer extremities of the concave curvature; and

(2) a flexible flap having a first and second portions, the first portion being attached to the valve seat outside a region encompassed by the orifice, and the second portion assuming the concave curvature of the seal ridge when the valve is in a closed position and being free to be lifted from the seal ridge when a fluid is passing through the orifice.

19. The filtering face mask of claim 18, wherein the concave curvature of the valve seat corresponds to a deformation curve exhibited by the second portion of the flexible flap when the first portion of the flexible flap is secured to a surface and the second portion is not secured and is exposed to a force having a magnitude equal to a mass of the second portion of the flexible flap multiplied by at least one gravitational unit of acceleration.

20. The filtering face mask of claim 19, wherein the concave curvature corresponds to the deformation curve exhibited by the second portion of the flexible flap when exposed to a force having a magnitude of the mass of the second portion of the flexible flap multiplied by 1.1 to 1.5 $g$ of acceleration, and the first portion of the flexible flap has been rotated at an angle $\Theta$ in the range of 25 to 65° from the horizontal.

21. The filtering face mask of claim 18, wherein the flexible flap exerts a substantially uniform force upon the seal ridge of the valve seat.

22. The filtering face mask of claim 18, wherein the exhalation valve has a single flexible flap that has a single second portion that is located below the first portion when the filtering face mask is held in an upright position.

23. The filtering face mask of claim 18, wherein the concave curvature is defined by a polynomial mathematical equation of at least the third order.

24. A filtering face mask that comprises:

(a) a mask body that has a shape adapted to fit over the nose and mouth of a person, the mask body having a filter media for removing contaminants from a fluid that passes through the mask body, there being an opening in the mask body that permits a fluid to exit the mask body without passing through the filter media, the opening being positioned on the mask body such that the opening is substantially directly in front of a wearer's mouth when the filtering face mask is placed on a wearer's face over the nose and mouth; and

(b) an exhalation valve attached to the mask body at the location of the opening, the exhalation valve having a flexible flap and a valve seat that includes an orifice and a seal ridge, the flexible flap being attached to the valve seat at a first end and resting upon the seal ridge when the exhalation valve is in a closed position, the flexible flap having a second free-end that is lifted from the seal ridge when a fluid is passing through the exhalation valve;

wherein, the fluid-permeable face mask can demonstrate a negative pressure drop when air is passed into the filtering face mask with a velocity of at least 0.8 m/s under a normal exhalation test.

25. The filtering face mask of claim 24, wherein the whole exposed surface of the mask body is fluid permeable to allow for an inward passage of a fluid except where the exhalation valve is positioned.

26. The filtering face mask of claim 24, wherein the orifice of the exhalation valve is 2 to 6 $cm^2$ in size.

27. The filtering face mask of claim 24, wherein the orifice is 3 to 4 $cm^2$ in size.

28. The filtering face mask of claim 24, wherein the exhalation valve has a single flexible flap with a single free portion, the free portion is positioned below the first portion of the flexible flap when the filtering face mask is held in an upright position, the first portion of the flexible flap being attached to a flap-retaining surface located outside the region encompassed by the orifice, the point of securement of the first portion of the flexible flap being distanced from the nearest portion of the orifice by 1 to 3.5 mm.

29. The filtering face mask of claim 24, wherein greater than 40 percent of airflow entering the filtering face mask exits the filtering face mask through the exhalation valve when airflow exceeds 50 liters per minute under a normal exhalation test and the face mask has a pressure drop of less than 2.5.

30. The filtering face mask of claim 24, wherein the negative pressure drop is demonstrated when air is passed into the filtering face mask at a velocity of at least 0.9 m/s.

31. The filtering face mask of claim 24, wherein a negative pressure is demonstrated at an air velocity in the range of 0.9 m/s to 1.3 m/s.

32. A method of making a unidirectional fluid valve, which method comprises:

(a) providing a valve seat that has an orifice circumscribed by a seal ridge, the seal ridge having a concave curvature when viewed from a side elevation, the concave curvature corresponding to a deformation curve demonstrated by a flexible flap that has a first portion secured to a surface at as a cantilever and has a second, non-secured portion exposed to a uniform force, a force having a magnitude equal to the mass of the second portion of the flexible flap multiplied by at least one gravitational unit of acceleration, or a combination thereof; and

(b) attaching a first portion of the flexible flap to the valve seat such that (i) the flexible flap makes contact with the seal ridge when a fluid is not passing through the orifice, and (ii) the second portion of the attached flexible flap is free to be lifted from the seal ridge when a fluid is passing through the orifice.

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